DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL

TEST SET, TELEPHONE AN / USM-181B

Headquarters, Department of the Army, Washington, D.C.
6 July 1972

C2, C4, C5 posted behind Basic

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 115-230 volt ac line connections, or the power supplies when the set is connected to an ac source. Serious injury or death may result.

DO NOT TAKE CHANCES!

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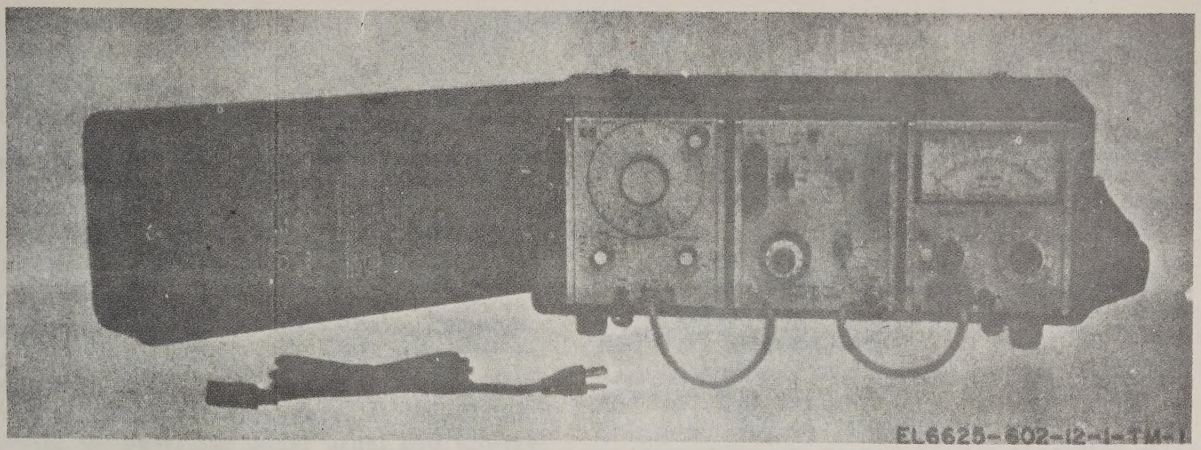

Figure 1-1. Test Set, Telephone AN / USM-181B (front view).

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual describes Test Set, Telephone AN/USM-181B (fig. 1-1) and provides instructions for installation, operation, and operator and organizational maintenance. It includes instructions for operation under usual and unusual conditions, cleaning and inspection of the equipment, and replacement of parts available to the operator and organizational repairmen.

1-2. Indexes of Publications

a. Refer to DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions given in TM38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Report of Packaging and Handling Deficiencies) as prescribed in AR 700-58 (Army), NAVSUP Pub 378 (Navy), AFR 71-4 (Air Force, and MCO P4030.29 (Marine Corps).

c. Discrepancy in Shipment Report (DISREP) (SF361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38 (Army), NAVSUP Pub 459 (Navy), AFM 75-34 (Air Force), and MCO P4610.19 (Marine Corps).

d. Reporting of Equipment Publication Improvements. The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, U S Army Electronics Command, ATTN: AMSEL-MA-CW, Fort Monmouth, N. J., 07703.

1-4. Administrative Storage

Refer to TM 740-90-1 for administrative storage.

1-5. Calibration

Refer to TM 11-6625-602-40-1 for calibration procedures.

Section II. DESCRIPTION AND DATA

1-6. Purpose and Use

Test Set, Telephone AN/USM-181B is a portable signal generator, voltmeter, and attenuator combination for measuring gain and attenuation in relation to frequency, crosstalk, noise, and power levels in telephone transmission lines, carrier circuits, filters, amplifiers, and attenuators. It covers both the audio frequency and carrier frequency ranges and is suitable for direct and general support and depot maintenance use. It operates on both alternating current (ac) or on storage batteries within the test set. The signal generator supplies a test signal through an impedance matching transformer in the attenuator to the external circuit under test. The voltmeter receives the test signal from the circuit under test through an impedance matching transformer in the attenuator and indicates the test signal level in decibels (referred to 1 milliwatt (mw) in 600 ohms) (dbm), in decibels (db) above or below the level of the test signal applied to the circuit, and in root mean square (rms) volts. The terminals on the attenuator can be connected to grounded, ungrounded, balanced, or single-ended circuits. The attenuator permits measurements on systems terminated in 135, 600, and 900 ohms, and bridging measurements on a 600-ohm basis. In the bridging mode, the input impedance is 10,000 ohms.

1-7. Technical Characteristics

Frequency range	5 Hz to 560 kHz.
Line-voltage input	115 or 230 volts, 48 to 440 Hz.
Weight:	
In carrying case	30½ pounds.
In shipping carton	44½ pounds.

a. Attenuator, Impedance Matching CN-947B/USM-181.

Input:	
Frequency range	50 Hz to 560 kHz.
Frequency response	± ½ db, 50 Hz to 560 kHz.
Balance	Better than 40 db.
Impedance	135, 600, 900, and bridging (10K) ohms, center tapped.

Insertion loss ..... Less than ¾ db at 1 kc.
Maximum level ..... +22dbm (10 volts rms at 600 ohms).

Output:
Frequency range ..... 50 Hz to 560 kHz.
Frequency response ... ±½ db, 50 Hz to 560 kHz.
Balance ..... Better than 40 db.
Impedance ..... 135, 600, and 900 ohms, center tapped.
Insertion loss ..... Less than ¾ db at 1 kc.
Distortion ..... Less than 1% ; 50 Hz to 560 kHz
Maximum level ..... +22 dbm (10 volts rms at 600 ohms).
Attenuation ..... 1 to 110 db.
Accuracy:
10-db section .....
100-db section .... Error is less than±0.25 db.
Error is less than±0.5 db.
Connections ..... Binding posts, which accept banana plugs on ¾-inch centers, and bNC connectors.

b. Voltmeter, Electronic ME260B / U.

Range:
0.001 to 300 volts rms
12 range settings.
—72 dbm to +52 dbm 12 range settings.
Frequency ..... 5 Hz to 2 MHz
Accuracy and temperature range:

Temperature	Accuracy		
	5 to 10 Hz	10 Hz to 1 MHz	1 to 2 MHz
0 to +50° C	±5%	±2%	±5%
—20 to 0° C	±8%	±8%	±8%

Nominal input impedance:
2 megohms shunted by approximately 40 uuf on 0.001-volt to 0.03-volt ranges, 25 uuf on 0.1-volt to 300-volt ranges.
Signal overload protection:
Fuse protected, 1 / 16 amp.
Dc isolation:
Signal ground may be±500 volts dc from the test set case.

c. Generator, Signal SG-543B / U.

Frequency range:
5 Hz to 1.2 MHz ..... 6 range settings.
Dial Accuracy ..... ±3%
Frequency response ..... ±3% into rated load.
Output impedance ..... 600 ohms.
Output level:
10 milliwatts (2.5 volts rms) maximum 600 ohms; 5 volts rms into open circuit; ungrounded, continuously adjustable 0 to 20 db.
Distortion ..... Less than 1%.
Hum and noise ..... Less than .01%.

d. Power Supply (Signal Generator and Voltmeter). Identical characteristics in the signal generator and voltmeter power supplies. Four rechargeable nickel cadmium batteries. Forty hour operation per recharge (20 hours at—20°C.), up to 500 recharging cycles. The recharging circuit operates on 115 or 230 volts ± 10 percent, 48 to 440 Hz.

1-8. Components of AN / USM-181B Test Set

Quantity	Item	Height (in.)	Depth (in.)	Width (in.)	Weight (lb.)	Fig. No.
1	Carrying case (with cover)	8⅜	13¼	19¼	14½	1-2
1	Voltmeter, Electronic ME-260B / U	6-3 / 32	8	5⅛	6½	1-4
1	Attenuator, Impedance Matching CN-947B / USM-181.	6-3 / 32	8	5⅛	6½	1-5
1	Generator, Signal SG-543B / U	6-3 / 32	8	5⅛	6	1-3
1	Shoulder strap, adjustable	.....	.....	.....	.....	1-2
3	Cable assembly, special purpose, electrical CX-1259 / USM-181B.	.....	.....	.....	.....	1-2
2	Cable assembly, radio frequency CG-3566 / U.	.....	.....	.....	.....	1-2
1	Fuse, spare (inside right side panel of ac voltmeter).	.....	.....	.....	.....	2-2

1-9. Description of AN / USM-181B Test Set

a. The test set includes three self-contained units (signal generator, attenuator, and voltmeter), power and signal cable assemblies, a carrying strap, and a carrying case. Figure 1-1 shows the major components of the test set assembled.

b. The signal generator, attenuator, and voltmeter are assembled in a carrying case (fig. 1-2). Power for the signal generator and voltmeter is supplied by rechargeable batteries contained in each assembly. When the test set is connected to an ac source (115 or 230 volts ac), the power supplies in the signal generator and voltmeter (FUNCTION switch set to ON) supply operating power and recharge the batteries.

c. The output of the signal generator and the input of the voltmeter are connected to the attenuator by the two patch cables (fig. 2-3). The voltmeter is adjusted to indicate the output of the attenuator. The input and output terminals of the

attenuator are connected to the transmission line under test to measure insertion loss and frequency response on the voltmeter (fig. 3-1).

1-10. Description of Generator, Signal SG-543B / U

The voltmeter (fig. 1-3) produces a frequency of 5 hertz (Hz) to 1.2 megahertz (MHz) in six ranges. It has an amplitude adjustment to 10 milliwatts (MW) maximum. All signal connectors and controls are located on the front panel. The ac source connection and line voltage selection switch are located at the rear of the assembly.

1-11. Description of Voltmeter, Electronic ME 260B / U

The voltmeter (fig. 1-4) measures voltages at frequencies from 5 hertz (Hz) to 2 megahertz (MHz). The meter indicates voltages of 0.001 to 300 volts rms full scale, and db levels of —72 to +52 dbm in 12 ranges (1, 3, 10 sequence). All signal connectors and controls are located on the front panel. The ac power connection and line voltage selector switch are located at the rear of the voltmeter assembly. The self-contained power supply functions automatically when the ac power is connected and the FUNCTION switch is set to ON.

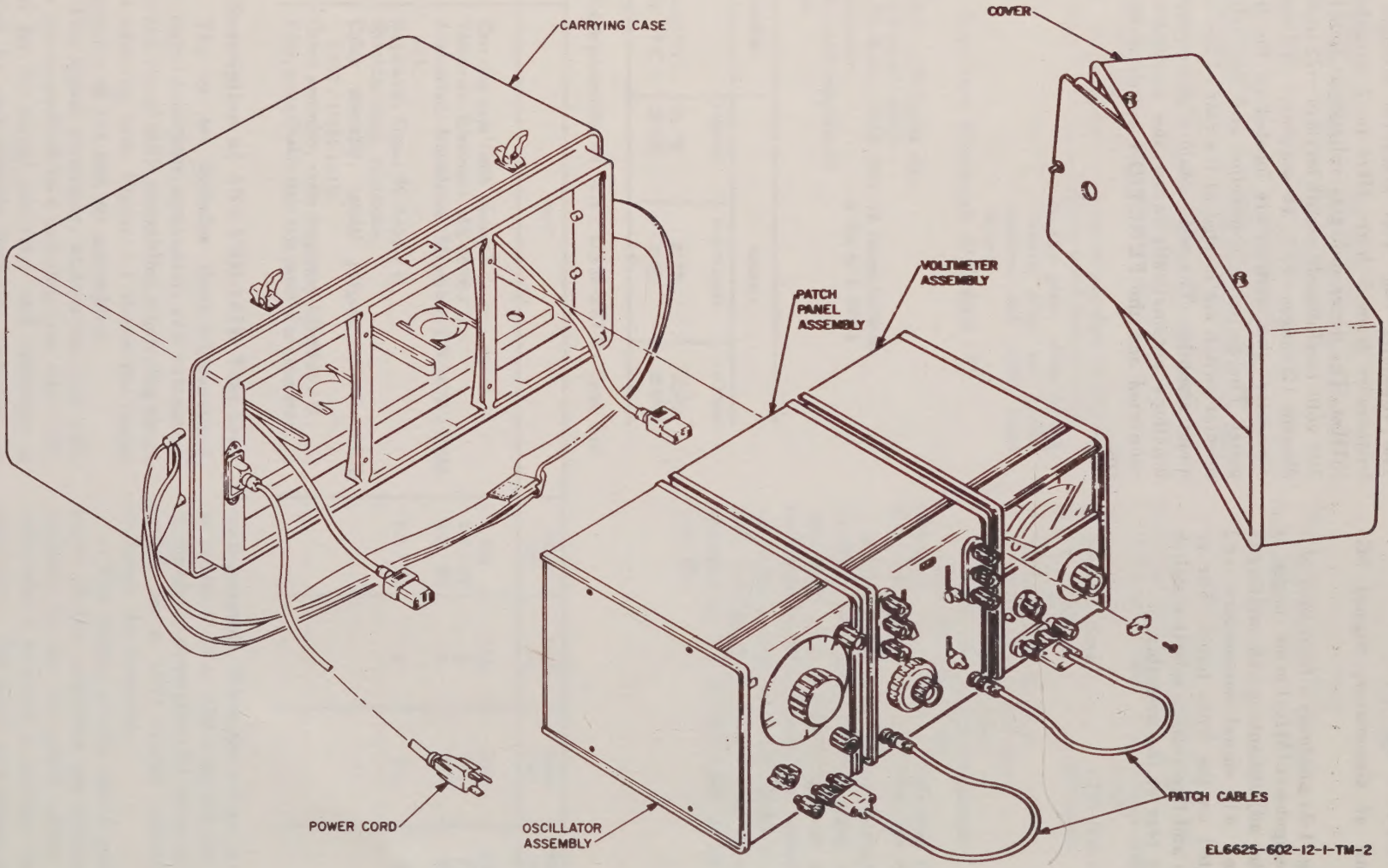

Figure 1-2. Test Set, Telephone AN/USM-181B (assembly diagram).

1-12. Description of Attenuator, Impedance Matching CN-947B / USM-181

The attenuator (fig. 1-5) requires no operating power. Operating frequencies are 50 Hz to 560 KHz. Attenuations developed are 1 db to 110 db in steps of 1 db or 10 db. The attenuator also provides matching impedances for input and output connections of 135, 600, 900 ohms. All connectors and controls are on the front panel.

1-13. Description of Minor Components

The minor components of the test set are shown in figure 1-2 and consist of a detachable ac power cord and two patch cables for attaching the voltmeter and signal generator to the attenuator. The patch cables are terminated on one end by a BNC-type connector, and on the other end by a banana plug with ¾-inch centers. The cables and power cord are stored in the cover of the instrument for transit, storage, or shipment.

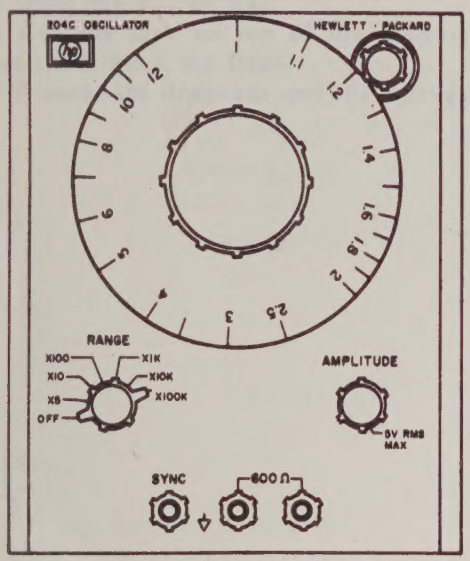

Figure 1-3. Signal Generator SG-543B / U controls, connectors, and indicators (front view).

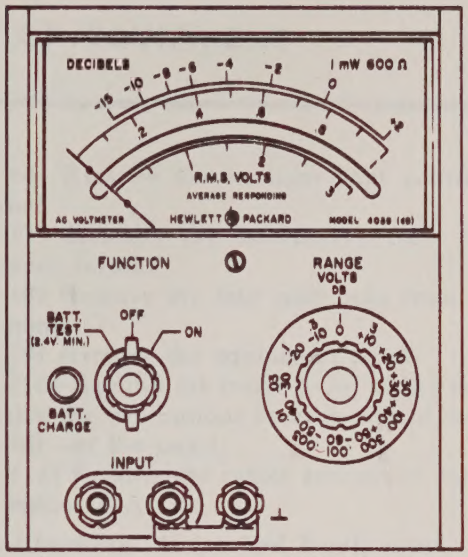

Figure 1-4. Voltmeter, Electronic ME-260B / U controls, connectors, and indicators (front panel).

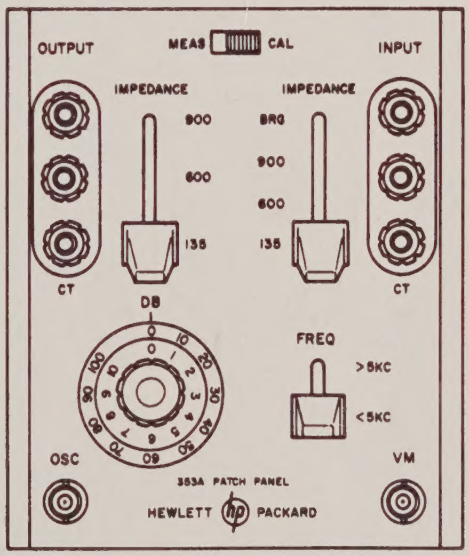

Figure 1-5. Attenuator, Impedance Matching CN-947B / USM-181 controls and connectors (front panel).

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CHAPTER 2

SERVICE UPON RECEIPT OF EQUIPMENT

2-1. Unpacking

a. Packaging Data. When packed for shipment, the entire unit is packed in one carton. A typical shipping carton and its contents are shown in figure 2-1. The dimensions of the shipping carton are 13⅛ inches by 18¾ inches by 24-7 / 8 inches. The volume is 4 cubic feet and the shipping weight (with test set included) is 44½ pounds.

b. Removing Contents.

(1) Cut the tape on top of the carton and fold back the flaps.

(2) Cut the steel strapping and the tape on top of the inner carton and fold back the flaps.

(3) Open the barrier bag.

(4) Cut the tape on top of the instrument carton and fold back the flaps.

(5) Remove the desiccant and the corrugated pad.

(6) Remove the envelope that contains the manual.

(7) Remove the instrument from the instrument carton.

(8) Remove the four post paks from the instrument.

(9) Remove the equipment cover.

(10) Remove the inside panel of the cover by pressing the two buttons on each end of the panel and lift out the panel.

(11) Remove the cables and power cord from the inside cover.

2-2. Checking Unpacked Equipment

a. Inspect the equipment for damage incurred during shipment. If equipment has been damaged, report the damage on DD Form 6 (para 1-3).

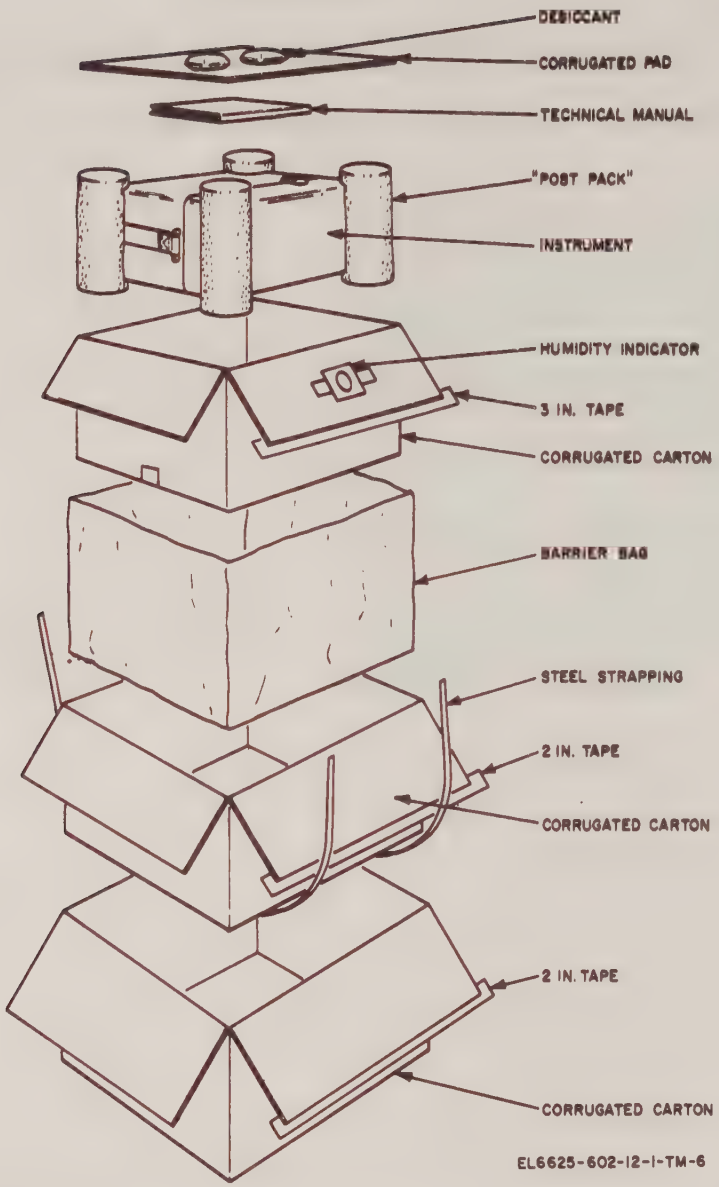

Figure 2-1. Test Set, Telephone AN / USM-181B (packaging diagram).

b. See that the equipment is complete as listed on the packing slip. If a packing slip is not available, check the equipment against the list of components (para 1-8). Report all discrepancies in accordance with TM 38-750. Shortages of minor assembly or part that does not affect proper functioning of the equipment should not prevent use of the equipment.

c. If the equipment has been used or reconditioned, see whether it has been changed by a modification work order (MWO). If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate. If modified, see that any operational instruction changes resulting from the modification have been entered in the equipment manual.

NOTE

Current MWO's applicable to equipment are listed in DA Pam 310-7.

2-3. Overload Fuse

CAUTION

Use only fuses of correct value when replacing a fuse. Overfusing can result in damage to the equipment.

Test Set, Telephone AN / USM-181B is shipped with a signal-overload fuse (fig. 2-2) installed in the voltmeter. The test set contains no power line fuses.

2-4. Connections

After the equipment has been unpacked and all components are present, make connections as shown in figure 2-3. The power cord is used only for ac operation or for charging the batteries, and need not be connected unless the battery voltages are low.

2-5. Initial Adjustment of Equipment

a. Set the ME-260B / U FUNCTION switch to OFF.

b. Rotate the ME-260B / U meter adjusting screw (below center of meter) clockwise until pointer is below zero. Continue clockwise rotation until pointer is exactly on zero.

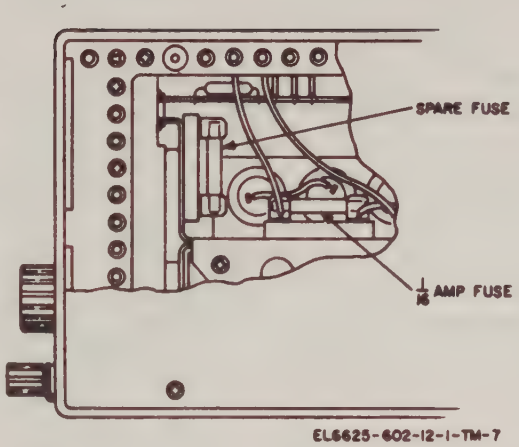

Figure 2-2. Overload fuse (location diagram).

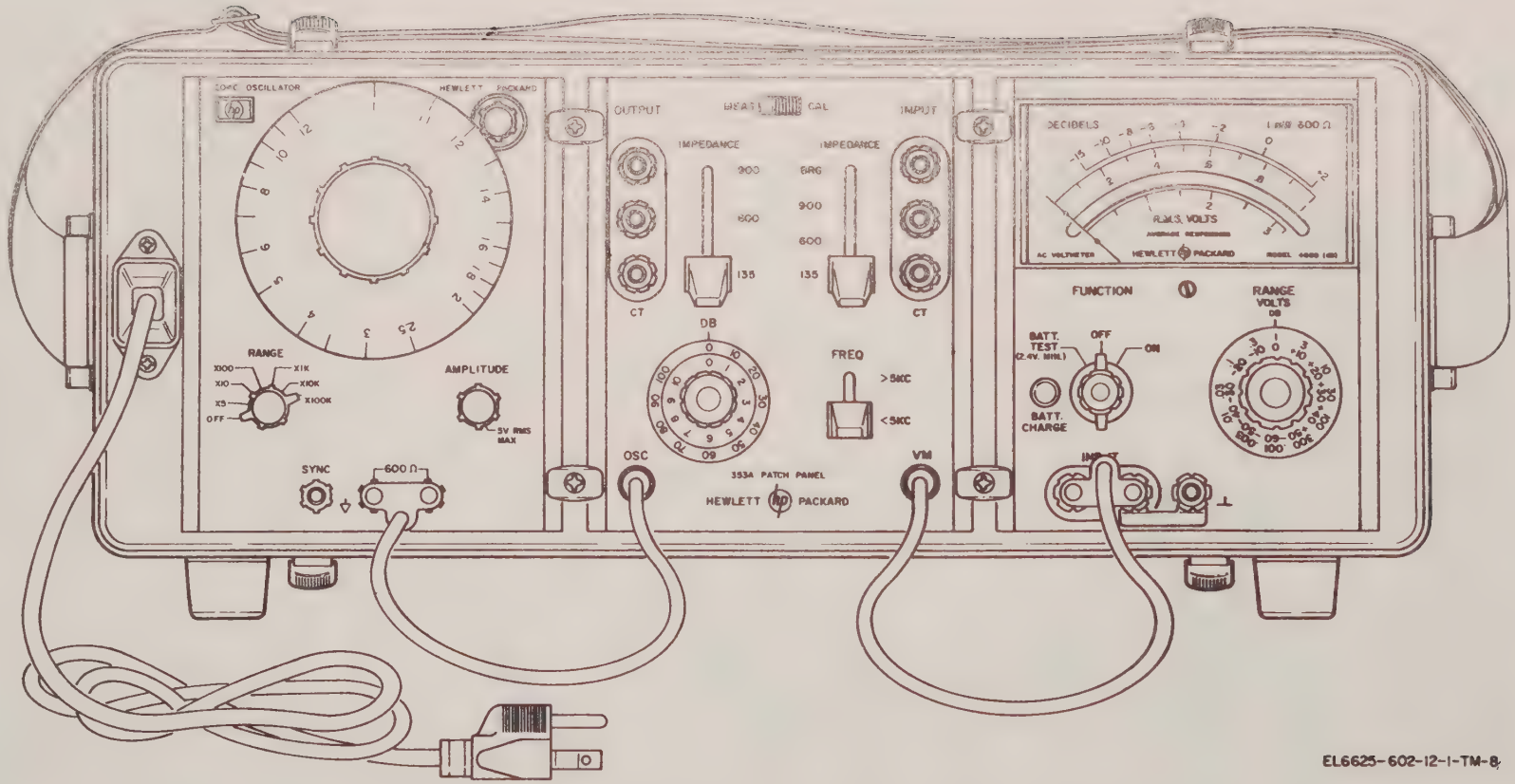

Figure 2-3. Test Set, Telephone AN/USM-181B (connection diagram).

c. If pointer passes zero, repeat *b* above.

d. Rotate meter adjusting screw approximately 15° counterclockwise to disconnect adjusting screw from meter movement.

e. If pointer moves off zero, repeat *b*, *c*, and *d* above.

f. Set RANGE control on SG-543B / U to OFF.

g. Set and hold ME-260B / U FUNCTION switch on BATT. TEST.

h. The voltmeter must indicate 2.4 volts on 0-3 range. If less than 2.4 volts, connect the test set to ac power source and set the ME-260B / U FUNCTION switch to ON (para 3-1).

i. Set SG-543B / U RANGE control to X100, FREQ. dial to 5, and AMPLITUDE control to MAX.

j. Set INPUT and OUTPUT IMPEDANCE control of CN-947B / USM-181 to 600.

k. Set attenuator MEAS-CAL switch to CAL.

l. Set attenuator DB control to 0.

m. Set attenuator FREQ switch to 5KC (less than 5 kc).

n. Set ME-260B / U RANGE switch to 3 and set FUNCTION switch to ON.

o. With the ac power cord disconnected from the power source, the voltmeter must indicate more than 2.3 volts on the 0-3 range. If the indication is less than 2.3 volts, recharge the batteries by connecting the power cord to the ac power source. The test set may be used while the batteries are being recharged.

CHAPTER 3

OPERATING INSTRUCTIONS

Section I. OPERATOR'S CONTROLS, INDICATORS, AND CONNECTORS

3-1. Damage From Improper Settings

The following precautions should be taken:

a. Before connecting equipment to an ac source, check the voltage selection switches at the rear of the signal generator and voltmeter for proper setting (115 or 230 volts).

b. Do not connect the test set to an ac power source when the ambient temperature is above 50 C. (122 F.). To do so will damage the batteries.

c. Do not connect the signal generator output terminals to a direct current (dc) voltage of reverse polarity and do not connect the output terminals to dc voltages greater than 25 volts. To do so may damage the output blocking capacitor.

d. Do not connect the attenuator INPUT and OUTPUT terminals to a dc voltage source. To do so may damage the transformers.

e. Limit the ac power to the INPUT and OUTPUT terminals of the attenuator to 10 milliwatts. More than 10 milliwatts may damage the transformers.

3-2. Generator, Signal SG-543B / U Operating Controls, Indicator, and Connectors

Control, indicator, or connector	*Function*
Voltage selection switch	Permits operation from either 115 or 230 volts ac.
FREQ. control	Selects desired frequency within range selected by RANGE control.
VERNIER control	Provides fine adjustment of frequency.
RANGE control	Selects range containing desired frequency and indicates the multiplying factor to be applied to the FREQ. dial reading to give output frequency.
AMPLITUDE control	Adjusts output amplitude level from 0 volt to 2.5 volts maximum into 600 ohms.
OUTPUT terminals	Provides output connections and cabinet ground connection.
Ac source voltage connection	Connects oscillator charging circuit to power receptacle on test set cabinet.

3-3. Attenuator, Impedance Matching CN-947B / USM-181 Operating Controls and Connectors

Control, indicator, or connector	*Function*
OSC connector	Receives the test signal from the oscillator.
VM connector	Supplies test signal for connection to the voltmeter.
DB control	Provides attenuation of 0 db to 110 db between the OSC terminal and the output terminals in steps of 1 db or 10 db.
FREQ switch	Limits frequency response to the range from 50 Hz to 5 kHz or from 5 kHz to 560 kHz
OUTPUT terminals	Provide output connections to the transmission line being tested.
IMPEDANCE control (OUTPUT).	Selects output impedances of 135, 600, or 900 ohms to match impedance of transmission line being tested.
INPUT terminals	Provide input connections from the transmission line being tested.
IMPEDANCE control (INPUT).	Selects input impedances to terminate the transmission line in 135, 600, 900, or 10,000 ohms.
MEAS-CAL switch	Selects measurement of the test set signal from the transmission line under test on MEAS, or measurement of the test signal from the signal generator on CAL.

3-4. Voltmeter, Electronic MD-260B / U Operating Controls, Indicators, and Connectors

Control, indicator, or connector	*Function*
Voltage selection switch (at rear of voltmeter).	Permits operation from 115 volts or 230 volts ac.
RANGE VOLTS DB control	Selects range containing voltages to be measured. Volts from 0.001 to 300; and from —72 to +52 db in 12 ranges (1, 3, and 10 sequence).
FUNCTION switch	Provides for battery test, and turning the voltmeter off or on.
FUNCTION switch indicator	Glows when FUNCTION switch is at ON.
BATT. CHARGE indicator	Lights red when the FUNCTION switch is at ON and the test set is connected to an ac power source.
INPUT terminals	Provide input connections and chassis ground.
DECIBELS RMS VOLTS meter	Indicates voltages or decibels within the range selected by the RANGE VOLTS DB control.
Adjusting screw	Provides a means of setting the meter pointer to zero.
Ac source voltage connection (at rear of voltmeter).	Connects the voltmeter to the power line receptacle on the test set cabinet.

Section II. OPERATION UNDER USUAL CONDITIONS

3-5. Types of Operation

a. The test set (AN / USM-181B) may be operated as a general telephone circuit measuring device to measure frequency response, attenuation, or insertion loss. The individual components may also be used independently for general purpose testing.

b. For types of operation using the test set, perform the following:

(1) Starting procedure (para 3-6).

(2) Procedure for the desired type of operation (para 3-7 through 3-11).

(3) Stopping procedure (para 3-12).

3-6. Starting Procedure

Make sure that the connections and initial adjustments described in paragraphs 2-4 and 2-5 have been preformed before this procedure is started.

a. Preliminary. Set the controls as follows:

Control	*Position*
Generator, Signal SG-543B / U:	
FREQ. control	Any
RANGE switch	OFF
AMPLITUDE control	Any
Attenuator, Impedance Matching CN-947B / USM-181:	
DB control	0
FREQ. switch	Same as SG-543B / U frequency.
OUTPUT IMPEDANCE switch	Any
INPUT IMPEDANCE switch	Any
MEAS-CAL switch	CAL
Voltmeter, Electronic ME-260B / U	
FUNCTION switch	OFF
RANGE VOLTS DB control	A range higher than voltage to be measured.

b. Starting.

(1) Set the SG-543B / U RANGE switch to desired range of frequency to be used and allow 20 seconds to stabilize.

(2) Set the ME-260B / U FUNCTION switch to ON and allow 20 seconds to stabilize.

CAUTION

If the transmission line to be tested has dc voltages applied to it, connect a dc holding coil to each end of the line. This allows for a dc path and enables the signal to enter and leave the transmission line. No dc should be allowed to flow through the patch panel (fig. 3-2).

3-7. Measurements of Filters, Amplifiers, or Attenuators

Start the equipment as instructed in paragraph 3-6 and perform the following for measuring characteristics of filters, amplifier, or attenuators (fig. 3-1).

a. Set the SG-543B / U RANGE switch and FREQ. dial to testing frequency.

b. Set the SG-543B / U AMPLITUDE control to testing power level.

c. Set the CN-947B / USM-181 IMPEDANCE switches (input and output) to match impedance of the equipment under test.

d. Set the CN-947B / USM-181 FREQ switch to correspond to testing frequency 5KC < (less than 5kc) of > 5KC (more than 5kc).

e. Set the ME-260B / U RANGE switch to the 3-volt range and the FUNCTION switch to ON.

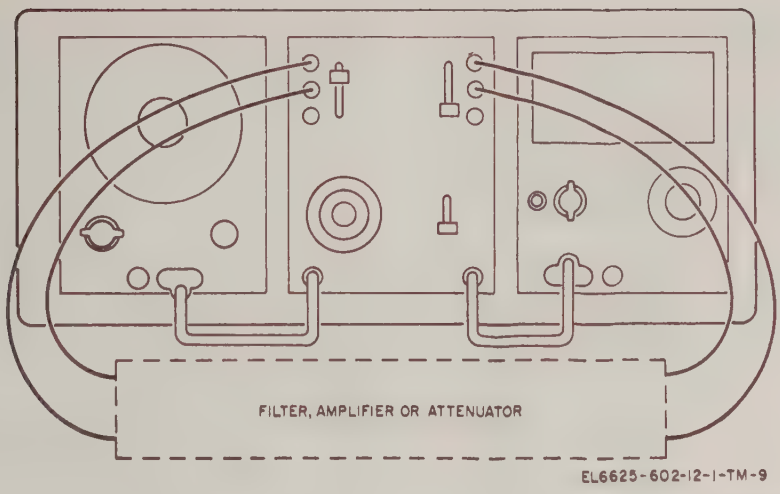

Figure 3-1. Filter, amplifier, and attenuator tests (connection diagram).

f. Various tests may be performed by varying the frequency of the signal generator with the FREQ. dial and RANGE switch, the amount of attenuation with the DB control on the attenuator and the output level of the signal generator with the AMPLITUDE control.

3-8. Measurements of Transmission Lines

a. To perform measurements on telephone transmission lines, a test set (AN / USM-181B) is required at each end of the line. The test set connected to the distant end of the line supplies the test signal. The test set connected to the local end of the line measures the amplitude of the test signal.

b. Start the equipment as instructed in paragraph 3-6 and perform the following:

(1) Distant AN / USM-181B.

(a) Set the SG-543B / U FREQ. dial and RANGE switch to the testing frequency.

(b) Set the CN-947B / USM-181 MEAS-CAL switch to CAL and the OUTPUT IMPEDANCE switch to match the impedance of the telephone line under test.

(c) If the telephone line has a dc potential, install a holding coil and blocking capacitor assembly to isolate the CN-947B / USM-181 and to complete the dc path for common battery circuits.

(d) Connect the CN-947B / USM-181 OUTPUT terminals to the telephone line.

(e) Adjust the SG543B / U AMPLITUDE control to the OUTPUT level specified for the system.

(f) Set the CN-947B / USM-181 MEAS-CAL switch to MEAS.

(2) Local AN / USM-181B.

(a) Set the ME-260B / U RANGE switch to power level specified for the system.

(b) Set the CN-947B / USM-181 MEAS-CAL switch to MEAS and the FREQ switch to correspond to testing frequency.

(c) Set the CN-947B / USM-181 INPUT IMPEDANCE switch to match the impedance of the telephone line under test, or to BRG if the line power is to be measured while remaining connected to its normal load.

(d) If the telephone line has a dc potential, install a holding coil and blocking capacitor assembly to isolate the CN-947B / USM-181 and to complete the dc path for common battery circuits.

(e) Connect the CN-947B / USM-181 INPUT terminals to the LINE jack when the line is to be terminated and tested, to the BRIDGE jack when the line to be tested is terminated by terminal equipment, or to the SWBD jack when the terminal equipment is to be tested (fig. 3-2).

(f) Read power levels on the ME-260B / U.

3-9. Voltage Measurements

a. Disconnect the ME-260B / U from the CN-947B / USM-181.

b. Set the voltmeter FUNCTION switch to ON and allow a 20-second warmup period.

c. Set the voltmeter RANGE VOLTS DB control to approximate level of voltage to be measured.

d. Connect the voltage to be measured to the INPUT terminals of the voltmeter.

NOTE

When measuring voltages from a high impedance source, hum pickup can affect the meter indications. The use of shielded leads will reduce pickup but may cause excessive circuit loading (at frequencies of 1 to 2 mc in the 300-volt range, the accuracy is reduced to ±10 percent).

3-10. Decibel Measurements

a. Disconnect the ME-260B / U from the CN-947B / USM-181.

b. Set the ME-260B / U FUNCTION switch to ON and allow a 20-second warmup period.

c. Set the ME-260 B / U RANGE VOLTS DB control to approximate decibel level to be measured.

d. Connect the signal voltage to be measured to the INPUT terminals of the voltmeter.

e. The db level is algebraic sum of the db scale indication and the RANGE VOLTS DB position.

NOTE

To measure power directly in dbm (0 dbm = 1 miliwatt into 600 ohms), the measurement must be made across 600 ohms. Measurements in differences of db may be obtained by direct indications of the meter and RANGE VOLTS DB control in each measurement is made same impedance value.

f. To compute dbm signal level on transmission lines having impedances other than 600 ohms, use the impedance correction graph (fig. 3-3) to convert the voltmeter db indication to dbm. Locate the transmission line impedance at the bottom of the graph and follow that impedance line up to the diagonal line. The dbm level is the algebraic sum of the level indicated on the meter and the correction shown on the graph. For example: If the indication on the DECIBELS scale is +2, the RANGE selector switch is in the +30 position, and the measurement is made across an impedance of 135 ohms, the corrected level is +39 dbm and is obtained as follows:

+ 2	(meter indication)
+30	(range switch position)
+32	(sum)
+ 7	(correction factor from graph)
+39 dbm	

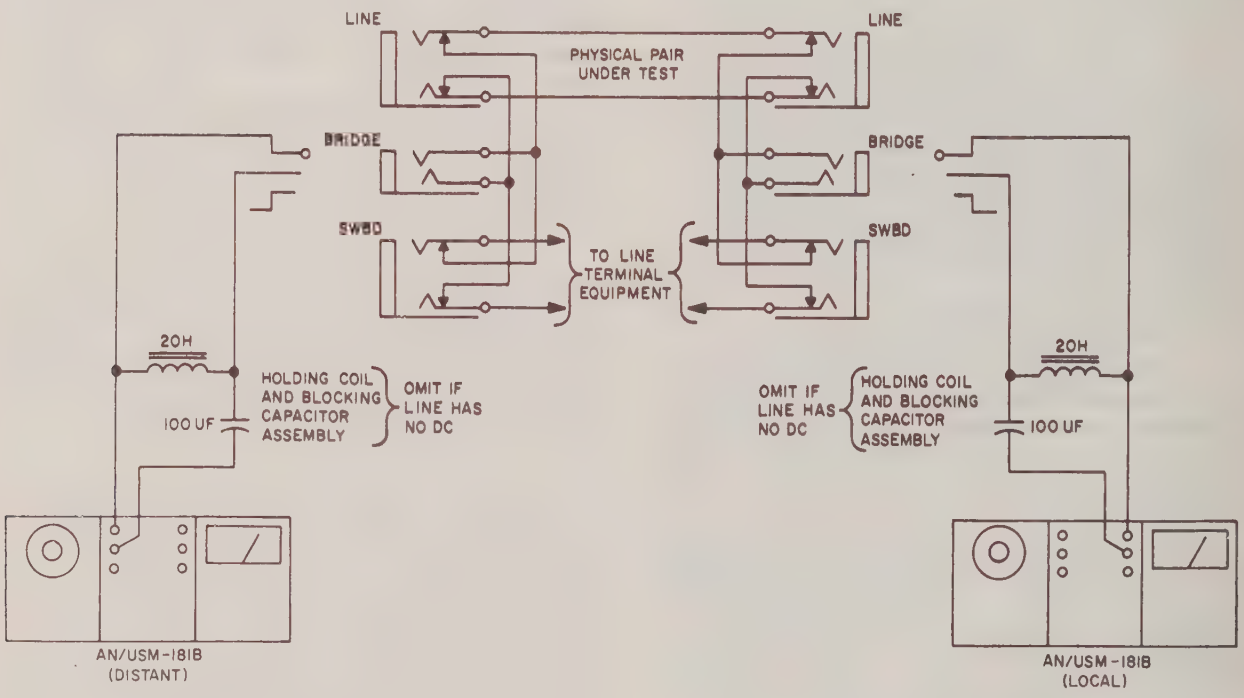

Figure 3-2. Transmission line tests (connection diagram).

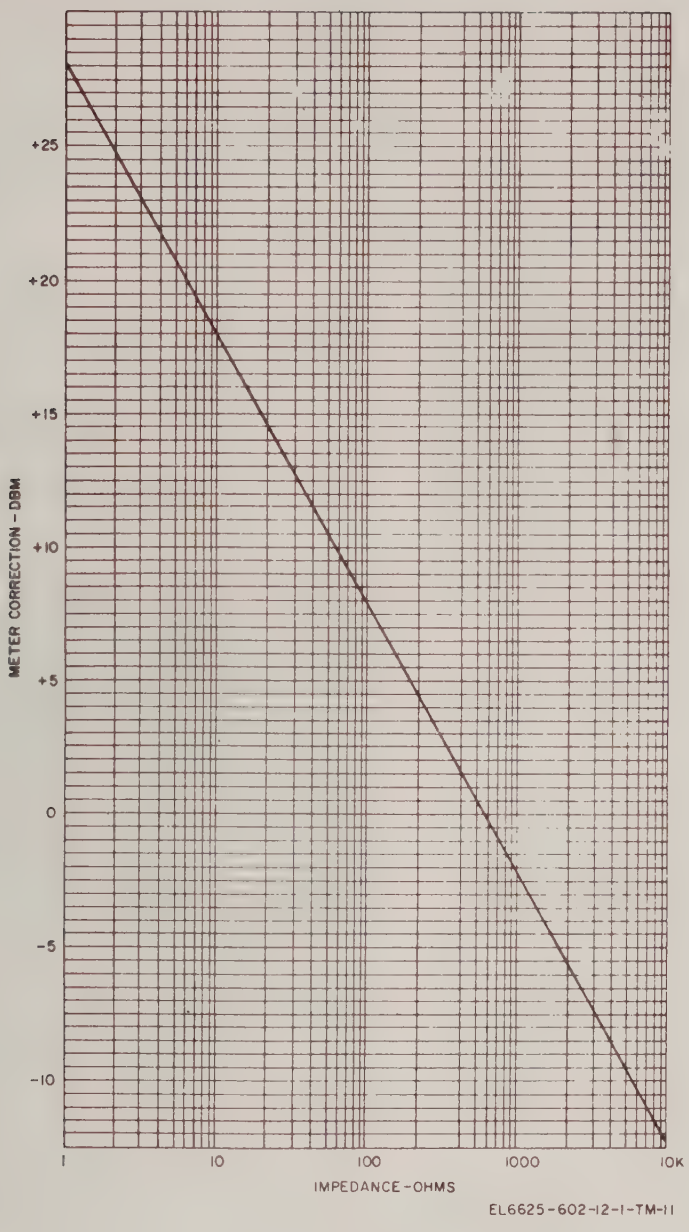

Figure 3-3. Impedance correction graph.

3-11. Use of Generator, Signal SG-543B / U with Other equipment

CAUTION

To prevent damage to the test set, install a blocking capacitor in series with the attenuator output when it is to be connected to a circuit on which there is a dc potential. The capacitor-voltage product (microfarad X volts) should be less than 200.

Example: For a 20-volt potential difference (200 ÷ 20 = 10), use a 10-microfarad (μf) or smaller capacitor.

Do not connect the ME-260B / U output across loads which are off ground by more than ±25 volts.

a. Disconnect the SG-543B / U from the CN-947B / USM-181.

b. Set the SG-543B / U RANGE switch and FREQ. control to desired frequency output. Allow 10 seconds to stabilize.

c. Set the SG-543B / U AMPLITUDE control to desired level.

d. Connect the SG-543B / U OUTPUT terminals to 600-ohm load.

NOTE

If connected to loads other than 600 ohms, an instrument for impedance matching

must be installed between the SG-543B/U and the load. The CN-947B/USM-181 may be used to match impedances of 135 or 900 ohms.

3-12. Stopping Procedure

a. Set the SG-543B/U RANGE switch to OFF, and disconnect the patch cable from the attenuator.

b. Set the ME-260B/U FUNCTION switch to OFF, and disconnect the patch cable from the attenuator.

NOTE

If equipment is to be carried, disconnect power cord from equipment and ac source (if connected.) Store power and patch cables in cover and install cover on equipment carrying case.

CHAPTER 4

MAINTENANCE

Section I. OPERATOR'S MAINTENANCE

4-1. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Test Set, Telephone AN/USM-181B are listed below, together with a reference to the paragraphs covering the specific maintenance function. These duties do not require special tools or test equipment.

a. Daily preventive maintenance checks and services (para 4-4).

b. Cleaning (para 4-5).

4-2. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 4-4 and 4-5 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (para 4-4, 4-9, and 4-10) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and the normal conditions; the References column lists the illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective action indicated, higher level maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

4-3. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the AN/USM-181B are required daily, weekly, and monthly.

a. Paragraph 4-4 specifies checks and services that must be accomplished daily or under the special conditions listed below:

(1) Before operating equipment.

(2) When the equipment is initially installed.

(3) When the equipment is reinstalled after removal for any reason.

(4) At least once each week if the equipment is maintained in standby condition.

b. Paragraphs 4-9 and 4-10 specify additional checks and services that must be performed weekly and monthly.

4-4. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Test Set, Telephone AN/USM-181B.	Inspect equipment for completeness and satisfactory condition.	App B
2	Exterior surfaces	Remove dirt, dust, grease, moisture, and fungus from the exterior of the case, front panel, controls, and meter. Inspect painted surfaces for bare spots, rust, and corrosion. Inspect meter glass and indicator lens for cracks and breaks.	Para 4-5
3	Line cord and connectors.	Inspect the line cord for breaks, deterioration, and loose connections. Check tightness of all connectors.	
4	Controls and indicators. . . .	While making operational checks (item 5), observe that mechanical action of each knob, dial, and switch is smooth and free of external and internal binding, and that there is no excessive looseness. Check meter for sticking or bent pointer.	Para 3-2, 3-3 and 3-4.

Sequence No.	Item	Procedure	References
5	Operation	Operate the equipment according to the procedures outlined in paragraphs 3-5 through 3-12. Be alert for any unusual indications and conditions.	Para 3-5 through 3-12.

4-5. Cleaning

Inspect the exterior surfaces of the AN / USM-181B. The exterior surfaces should be free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean, soft cloth.

WARNING

The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. DO NOT use near an open flame. Trichloroethane is not flammable, but exposure of the fumes to an open flame converts the fumes to highly toxic, dangerous gasses.

b. Remove grease, fungus, and ground-in dirt from the case. Use a cloth dampened (not wet) with cleaning compound.

c. Remove dust or dirt from plugs and jacks with a brush.

CAUTION

Do not press on meter face (glass) when cleaning; the meter may be damaged.

d. Clean the front panels, meter, and control knobs with a soft, clean cloth. If necessary, use mild soap.

Section II. ORGANIZATIONAL MAINTENANCE

4-6. Scope of Organizational Maintenance

a. This section contains instructions covering organizational maintenance of Test Set, Telephone AN / USM-181B. It includes instructions for performing preventive and periodic maintenance services, and repair function to be accomplished by the organizational repairman.

b. Organizational maintenance of Test Set, Telephone AN / USM-181B includes—

(1) Weekly preventive maintenance checks and services (para 4-9).

(2) Monthly preventive maintenance checks and services (para 4-10).

(3) Touchup painting (para 4-11).

(4) Troubleshooting (para 4-12 and 4-13).

(5) Replacement of easily accessible items (para 4-14).

4-7. Organizational Preventive Maintenance

a. Preventive maintenance is the systematic care, inspection, and servicing of equipment to maintain it in serviceable condition, prevent breakdowns, and assure maximum operational capability. Preventive maintenance is the responsibility of all categories of maintenance concerned with the equipment, and includes the inspection, testing, and repair or replacement of parts, subassemblies, or units that inspection and tests indicate would probably fail before the next scheduled periodic service. Preventive maintenance checks and services of Test Set, Telephone AN / USM-181B at the organizational level are made weekly and monthly unless otherwise directed by the commanding officer. The preventive maintenance checks and services should be scheduled concurrently with the periodic service schedule of the carrying vehicle for all vehicular installations.

b. Maintenance forms and records to be used and maintained on this equipment are specified in TM 38-750.

4-8. Weekly and Monthly Preventive Maintenance

Perform the maintenance functions indicated in the weekly and monthly preventive maintenance checks and services charts (para 4-9 and 4-10) on the AN / USM-181B at the intervals specified and in the sequence listed. Whenever an abnormal condition or result is observed, take corrective action in accordance with the paragraph listed under References. All deficiencies and shortcomings will be recorded, and those deficiencies not corrected during the preventive maintenance checks and services tests will be reported to higher level maintenance as specified in TM 38-750. Equipment that has deficiencies which cannot be corrected at the organizational level will be deadlined in accordance with TM 38-750. Equipment maintained in a standby condition (ready for immediate operation) must have monthly maintenance checks and services. Equipment in limited storage (requires services before operation) does not require monthly preventive maintenance.

NOTE

A month is defined as approximately 30 calendar days of 8-hour-a-day operation. For 16-hour-a-day operation, the monthly

preventive maintenance checks and services will be performed at 15-day intervals. Adjustment of the maintenance interval must be made to compensate for any unusual operating conditions.

4-9. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Cables	Inspect cables for chafed, cracked, or frayed insulation. Replace connectors that are broken, stripped, or worn excessively.	Para 4-14
2	Latches	Inspect latches for looseness. Replace or tighten as necessary.	Para 4-14.
3	Metal surfaces	Inspect exposed metal surfaces for corrosion, scratches, and pitting. Clean and touch up paint as required.	Para 4-11
4	Panel mounting screws	Check all panel screws and retainers for tightness or breakage. Replace or tighten as necessary.	Para 4-14

4-10. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Publications	See that all publications are complete, serviceable, and current.	DA Pam 310-4
2	Modifications	Check DA Pam 310-7 to determine if new applicable MWO's have been published. All URGENT MWO's must be applied immediately. All NORMAL MWO's must be scheduled.	TM 38-750 and DA Pam 310-7
3	Spare parts	Check all spare parts (operational and organizational) for general condition and method of storage. No overstock should be evident, and all shortages must be on valid requisitions.	App B
4	Jacks	Inspect jacks for snug fit and good contact.	
5	Terminals	Inspect all terminals for tightness and good contact.	
6	Carrying strap	Inspect carrying strap for wear or cuts.	Para 4-14
7	Batteries	Check the batteries in the signal generator and voltmeter assemblies.	Para 2-5

4-11. Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on bare metal to protect it from further corrosion.

4-12. General Troubleshooting Information

Troubleshooting this equipment is based on the operational check (item 5) in the daily preventive maintenance checks and services chart. To troubleshoot the equipment, perform all functions given in the daily preventive maintenance checks and services chart (para 4-4) and proceed through the items until an abnormal condition or result is observed. Check the abnormal condition against the Trouble symptom column in the troubleshooting chart (para 4-13), and perform the checks and corrective actions indicated. If the corrective measures indicated do not result in correction of the trouble, higher level maintenance is required.

4-13. Troubleshooting Chart

Item No.	Trouble symptom	Probable trouble	Checks and corrective measures
1	Meter indicates less than 2.4 volts under test conditions outlined in paragraph 2-5*f* and *g*.	Low battery voltage in voltmeter.	Charge voltmeter batteries.
2	Meter indicates less than 2.3 volts under test conditions outlined in paragraph 2-5*i* through *n*.	Low battery voltage in signal generator.	Charge signal generator batteries.
3	Meter indicates zero under test conditions outlined in 1 and 2 above.	Defective fuse or loose connections.	Check connections.

4-14. Replacement of Easily Accessible Items

a. Replacement of Plastic Retainer.

(1) Remove the screw holding the broken or cracked retainer.

(2) Replace with new retainer and screw.

b. Replacement of Shoulder Strap.

(1) Remove the four screws and plastic retainers holding the assemblies in the carrying case.

(2) Remove the assemblies from the carrying case and disconnect the ac power cords from the voltmeter and signal generator.

(3) Remove the nuts and washers holding the strap loop to the carrying case.

(4) Remove the strap from the strap loops.

(5) Replace the new strap on the strap loops.

(6) Replace the strap loops, nuts, and washers.

(7) Connect the ac power cords to the signal generator and the voltmeter.

(8) Replace the assemblies in the carrying case.

(9) Install the retainers and the screws holding the assemblies in the carrying case.

c. Replacement of Cover Latch.

(1) Remove the four screws and plastic retainers holding the assemblies in the carrying case.

(2) Remove the assemblies from the carrying case and disconnect the ac power cords from the voltmeter and signal generator.

(3) Remove the two nuts and washers holding the latch.

(4) Install the new latch, using the two nuts and washers.

(5) Connect the ac power cords to the voltmeter and signal generator.

(6) Replace the assemblies in the carrying case.

(7) Replace the four screws and plastic retainers.

d. Replacement of Internal Ac Power Cords.

(1) Remove the four screws and plastic retainers that hold the assemblies in the carrying case.

(2) Remove the assemblies from the carrying case and disconnect the ac power cords from the rear of the voltmeter and signal generator.

(3) Remove the two screws holding the external ac connector to the carrying case and remove internal ac power cords.

(4) Install the new internal ac power cords and replace the two screws holding the external ac connector to the carrying case.

(5) Connect the internal ac power cords to the rear of the voltmeter and signal generator.

(6) Replace assemblies in carrying case.

(7) Replace the four screws and plastic retainers.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

5-1. Disassembly of Equipment

To prepare the test set for shipment and storage:

a. Disconnect the two cables and the power cord.

b. Replace cables and power cord in cover of carrying case and install panel in cover.

c. Install carrying case cover on test set and secure with the latches.

5-2. Repackaging for Shipment or Limited Storage

The exact procedure for repackaging depends on the material available and the conditions under which the equipment is to be shipped or stored. Adapt the procedures outlined below whenever circumstances permit. The information concerning the orginal packaging (para 2-1) will also be helpful.

a. Material Requirements. The following materials are required for packaging Test Set, Telephone AN / USM-181B. For stock numbers of materials, consult SB 38-100.

Material	*Quantity*
Cardboard carton	4 cubic feet
Gummed tape	10 feet
Filler material	3.5 cubic feet
Padded paper	10 feet

b. Packaging. Package the test set as outlined below:

(1) Wrap instrument in padded paper.

(2) Place approximately 4 inches of filler material in bottom of carton.

(3) Place instrument in center of carton.

(4) Replace the envelope containing the manuals.

(5) Pack at least 4 inches of filler material around and on top of instrument.

(6) Fold flaps closed on carton and seal with gummed tape.

5-3. Authority for Demolition

The demolition procedures given in paragraph 5-4 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon the order of the commander.

5-4. Methods of Destruction

The tactical situation and time available will determine the method to be used when destruction of equipment is ordered.

a. Smash. Use sledges, axes, hammers, crowbars, and any other heavy tools available to smash the interior assemblies of the set.

(1) Use the heaviest tool on hand to smash the connections, meter, knobs, and dials.

(2) Remove the assemblies from the carrying case. With a heavy hammer or bar, smash as many of the exposed parts of the various assemblies as possible.

b. Cut. Use axes, handaxes, machetes, and similar tools to cut cabling and wiring. Use a heavy axe or machete to cut power cables.

WARNING

Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.

c. Burn. Burn the technical manual first. Burn as much of the equipment as is flammable; use gasoline, oil, flamethrowers, and similar materials. Pour gasoline on the cut cables, cords, and internal wiring and ignite the gasoline. Use incendiary grenades to complete the destruction of the set.

d. Explode. Use explosives to complete demolition or to cause maximum damage, before burning, when time does not permit complete demolition by other means. Powder charges, fragmentation grenades, or incendiary grenades may be used. Incendiary grenades usually are most effective if destruction of small parts and wiring is desired.

(1) Use a fragmentation grenade to destroy the interior of the AN / USM-181B. Slide the center assembly out of carrying case, drop the grenade into the carrying case, and drop the center assembly back into place.

(2) Use a powder charge to destroy the AN / USM-181B. Lift the center assembly out of carrying case and install the charge.

(3) For quick destruction of the AN / USM-181B, place an incendiary grenade on top of the set. Get away from the set after the grenade is placed.

e. Dispose. Bury or scatter destroyed parts or throw them into nearby waterways. This is particularly important if a number of parts have not been completely destroyed.

APPENDIX A

REFERENCES

Following is a list of applicable publications available to the operator and organizational repairman of Test Set, Telephone AN / USM-181B.

DA Pam 310-4	Index of Technical Manual, Technical Bulletins, Supply Manuals (types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U S Army Equipment Index of Modification Work Orders.
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies and Equipment Used by the Army.
TB SIG 222	Solder and soldering.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 38-750	The Army Maintenance Management System (TAMMS).

APPENDIX B

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

B-1. General

This appendix provides a summary of the maintenance operations covered in the equipment literature. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

b. Test. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc. This is accomplished with external test equipment and does not include operation of the equipment and operator type tests using internal meters or indicating devices.

c. Service. To clean, to preserve, to charge, and to add fuel, lubricants, cooling agents, and air. If it is desired that elements, such as painting and lubricating, be defined separately, they may be so listed.

d. Adjust. To rectify to the extent necessary to bring into proper operating range.

e. Align. To adjust two or more components or assemblies of an electrical or mechanical system so that their functions are properly synchronized. This does not include setting the frequency control knob of radio receivers or transmitters to the desired frequency.

f. Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

g. Install. To set up for use in an operational environment such as encampment site, or vehicle.

h. Replace. To replace unserviceable items with serviceable like items.

i. Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes, but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

j. Overhaul. Normaliy, the highest degree of maintenance performed by the Army in order to minimize time work in process is consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by maintenance standards in technical publications for each item of equipment. Overhaul normally does not return an item to like new, zero mileage, or zero hour condition.

k. Rebuild. The highest degree of materiel maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance category. Rebuild reduces to zero the hours or miles the equipment, or component thereof, has been in use.

l. Symbols. The uppercase letter placed in the appropriate column indicates the lowest level at which that particular maintenance function is to be performed.

B-3. Explanation of Format of Section II, Maintenance Allocation Chart

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies and modules with the next higher assembly.

b. Column 2, Functional Group. Column 2 lists the noun names of components, assemblies, subassemblies and modules on which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the maintenance category at which performance of the specific maintenance function is authorized. Authorization to perform a function at any category also includes authorization to perform that function at higher categories. The codes used represent the various maintenance categories, as follows:

Code	*Maintenance category*
C	Operator / crew
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

d. Column 4, Tools and Test Equipment. Column 4 specifies, by code, those tools and test equipment required to perform the designated function. The numbers appearing in this column refer to specific tools and test equipment which are identified in table I.

e. Column 5, Remarks. Self-explanatory.

B4. Explanation of Format of table I, Tool and Test Equipment Requirements

The columns in table I are as follows:

a. Tools and Equipment. The numbers in this column coincide with the numbers used in the tools and equipment column of the Maintenance Allocation Chart. The numbers indicate the applicable tool for the maintenance function.

b. Maintenance Category. The codes in this column indicate the maintenance category normally allocated the facility.

c. Nomenclature. This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

d. Federal Stock Number. This column lists the Federal stock number of the specific tool or test equipment.

e. Tool Number. Not used.

SECTION II. MAINTENANCE ALLOCATION CHART

GROUP NUMBER	COMPONENT ASSEMBLY NOMENCLATURE	MAINTENANCE FUNCTIONS											TOOLS AND EQUIPMENT	REMARKS
		INSPECT	TEST	SERVICE	ADJUST	ALIGN	CALIBRATE	INSTALL	REPLACE	REPAIR	OVERHAUL	REBUILD		
1.	TEST SET, TELEPHONE AN/USM-181B	O/C												
				O/C										Clean
			O										1 thru 9,11	Operational, Continuity of Cords and Cables
										O			12	Replacement of easily repaired items
			H										1 thru 9,11	
					H								1 thru 9,11	Voltage, Current, Distortion
						H							1 thru 9,11	Frequency, Tracking
										H			10	
2.	ATTENUATOR, IMPEDANCE MATCHING CN-947B/USM-181								O				12	
										O			12	Easily replaced parts
										H			10	
3.	VOLTMETER, ELECTRONIC ME-260B/U								O				12	
										O			12	Easily replaced parts
										H			10	
4.	GENERATOR, SIGNAL SG-543B/U								O				12	
										O			12	Easily replaced parts
										H			10	
5.	Cable assembly, Radio frequency									O			12	
6.	Case, Test Set CY-7047/USM-181B									O			12	
7.	Cable assembly, Special purpose electrical CX-1259/USM-181B									O			12	

TABLE I. TOOL AND TEST EQUIPMENT REQUIREMENTS

TOOLS AND EQUIPMENT	MAINTENANCE CATEGORY	NOMENCLATURE	FEDERAL STOCK NUMBER	TOOL NUMBER
	H, D	OSCILLOSCOPE AN/USM-281/A	6625-229-2201	1
	H, D	METER TEST SET, TS-682/GSM-1	6625-669-0747	2
	H, D	FREQUENCY CALIBRATOR SET AN/URM-18	6625-376-9793	3
	H, D	FREQUENCY METER AN/USM-207A	6625-044-3228	4
	H, D	ANALYZER, SPECTRUM TS-723/U	6625-668-9418	5
	H, D	ELECTRONIC VOLTMETER ME-30E/U	6625-643-1670	6
	H, D	MULTIMETER TS-352B/U	6625-553-0142	7
	H, D	MULTIMETER ME-26B/U	6625-913-9781	8
	H, D	TEST SET, TRANSISTOR TS-1836B/U	6625-168-0954	9
	H, D	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	5180-605-0079	10
	H, D	OSCILLATOR 0-1025/U (HP 200CD)	6625-518-4659	11
	O	TOOL KIT ELECTRONIC EQUIPMENT TK-101/G	5180-064-5178	12

By Order of the Secretary of the Army:

BRUCE PALMER, JR.
General, U. S. Army
Acting Chief of Staff

Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:
USASA (2)
CNGB (1)
ACSC-E (2)
Dir of Trans (1)
COE (1)
TSG (1)
DCSLOG (1)
USAARENBD (2)
USAMB (10)
USACDC (2)
USACDC Agcy (1)
AMC (1)
CONARC (5)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (4)
USARYIS (5)
USAREUR (6)
LOGCOMDS (5)
MICOM (4)
TECOM (2)
USASTRATCOM (4)
USAESC (70)
MDW (1)
Armies (2)
Corps (2)
1st Cav Div (3)
Svc Colleges (2)
USASESS (10)
USAADS (2)
USAFAS (2)
USAARMS (2)
USAIS (2)
USAES (2)
USAINTS (3)
WRAMC (1)
USACDCEC (10)
Instl (2) except
Ft Gordon (10)
Ft Huachuca (10)
WSMR (3)
Ft Carson (21)
Ft Richardson (ECOM Ofc) (2)
Army Dep (2) except
LBAD (14)
SAAD (30)
TOAD (14)
LEAD (7)
NAAD (5)
SVAD (5)
ATAD (10)
Gen Dep (2)
Sig Sec Gen Dep (5)
Sig Dep (10)
SigFLDMS (2)
ATS (1)
USAERDAA (2)
USAERDAW (5)
USACRREL (2)
MAAG (1)
USARMIS (1)
Units org under fol TOE (1 cy each):
7
11-75
11-85
11-95
11-117
11-158
11-357
11-367
11-368
11-500(AA-AC)
29-1
29-15
29-16
29-21
29-25
29-26
29-35
29-36
29-134
29-136
29-205
29-206
29-427
29-500
37

NG: None.

USAR: None.

For explanation of abbreviations used, see AR 310-50.

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